

EXCEPTIONAL EVENTS TECHNICAL SUPPORT DOCUMENT FOR EPA CONCURRENCE WITH O₃ EXCEEDANCES CAUSED BY A STRATOSPHERIC O₃ INTRUSION IN THE UINTA BASIN OF UTAH ON JUNE 8-9, 2015

In the spring of 2016, the Ute Indian Tribe of the Uintah and Ouray Reservation (Ute Tribe), the State of Utah Department of Environmental Quality (UT DEQ), and the EPA Region 8 office became aware of a stratospheric O₃ intrusion that may have caused O₃ exceedances at four O₃ monitoring sites operated by the Ute Tribe in the Uinta Basin of Utah on June 8-9, 2015. Under the Exceptional Events Rule (EER), air agencies can request the exclusion of event-influenced data, and the EPA can agree to exclude these data, from the data set used for certain regulatory decisions. Although the EER applies to all states; to local air quality agencies to whom a state has delegated relevant responsibilities for air quality management including air quality monitoring and data analysis; and to tribal air quality agencies operating ambient air quality monitors that produce regulatory data, under the Tribal Authority Rule (TAR) at 40 CFR §49.2, tribes can request EPA's assistance in implementing the provisions of the Clean Air Act (CAA), including the provisions of the EER.

At the request of the Ute Tribe and in accordance with the provisions of the TAR, the EPA Region 8 office began working with the Ute Tribe and the UT DEQ to investigate the potential stratospheric O₃ intrusion claimed to have caused O₃ exceedances at four tribal O₃ monitoring locations in the Uinta Basin of Utah on June 8-9, 2015. Ultimately, also at the request of the Ute Tribe, the EPA Region 8 office assisted in drafting the exceptional events demonstration and facilitating the public comment process.¹ The public comment process, which ran from August 30 through September 29, 2016,² resulted in a single public submission from UT DEQ supporting the Ute Tribe demonstration.³ Following the public comment process, the Ute Tribe formally submitted the exceptional events demonstration and requested EPA's review.⁴ Because EPA Region 8 played a significant role in drafting the exceptional events demonstration, EPA's Office of Air and Radiation and Office of Air Quality Planning and Standards has independently reviewed the submittal and prepared this Technical Support Document supporting a concurrence with the Ute Tribe's request to exclude data under the EER. The remainder of this document summarizes the event and EPA's review process.

EXCEPTIONAL EVENTS RULE REQUIREMENTS

EPA promulgated the EER in 2007, pursuant to the 2005 amendment of CAA section 319. In 2016, EPA finalized revisions to the EER. The 2007 EER and the 2016 EER revisions added

¹ See email dated August 29, 2016, from Kyle R. Montour, Attorney with Fredericks Peebles & Morgan LLP representing the Ute Tribe, to Jody Ostendorf, US EPA Region 8, requesting that EPA conduct a public comment process for the June 8-9, 2015 stratospheric intrusion exceptional event demonstration provided to EPA in draft format on August 23, 2015, in accordance with 40 CFR §50.14.

² See documentation of announcement of public comment period for O₃ NAAQS exceedances occurring June 8 and 9, 2015, in the Uinta Basin of Utah. The announcement was posted on EPA's website at <https://www.epa.gov/air-quality-analysis/treatment-data-influenced-exceptional-events> from August 30 through September 29, 2016.

³ See letter dated September 21, 2016, from Alan Matheson, Executive Director Utah Department of Environmental Quality, to Shaun McGrath, US EPA Region 8 Regional Administrator, supporting the exceptional events package demonstrating the impact of stratospheric O₃ intrusion on the O₃ data from monitors operate by the Ute Tribe for June 8-9, 2015.

⁴ See email dated November 22, 2016, from Minnie Grant, Ute Tribe, to Richard Payton, US EPA Region 8, requesting that EPA review the final June 8-9, 2015 stratospheric intrusion exceptional event demonstration in accordance with 40 CFR §50.14(c)(3).

sections 50.1(j)-(r), 50.14, and 51.930 to title 40 of the Code of Federal Regulations (CFR). These sections contain definitions, criteria for EPA approval, procedural requirements, and requirements for air agency demonstrations. EPA reviews the information and analyses in the air agency's demonstration package using a weight of evidence approach and decides to concur or not concur. The demonstration must satisfy all of the EER criteria for EPA to concur with excluding the air quality data from regulatory decisions.

Under 40 CFR §50.14(c)(3)(iv), the air agency demonstration to justify data exclusion must include:

- A. "A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);"
- B. "A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;"
- C. "Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times" to support requirement (B) above;
- D. "A demonstration that the event was both not reasonably controllable and not reasonably preventable;" and
- E. "A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event."⁵

In addition, the air agency must meet several procedural requirements, including:

- 1. submission of an Initial Notification of Potential Exceptional Event and flagging of the affected data in the EPA's Air Quality System (AQS) as described in 40 CFR §50.14(c)(2)(i),
- 2. completion and documentation of the public comment process described in 40 CFR §50.14(c)(3)(v), and
- 3. implementation of any applicable mitigation requirements as described in 40 CFR §51.930.

For data influenced by exceptional events to be used in initial area designations, air agencies must also meet the initial notification and demonstration submission deadlines specified in Table 2 to 40 CFR §50.14.

Some air agencies, including the Ute Tribe, submitted exceptional events demonstrations under

⁵ A natural event is further described in 40 CFR §50.1(k) as "an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions."

the provisions of the 2007 EER. However, because the 2016 EER is currently in effect, this document discusses the specific requirements of the 2016 EER and also provides a crosswalk between the provisions of the 2007 EER and the 2016 EER. We include below a description of the EER criteria identified in 40 CFR §50.14(c)(3)(iv).

Regulatory Significance

The 2016 EER includes regulatory language that applies the provisions of CAA section 319 to a specific set of regulatory actions. As identified in 40 CFR §50.14(a)(1)(i), these regulatory actions include initial area designations and redesignations; area classifications; attainment determinations (including clean data determinations); attainment date extensions; findings of State Implementation Plan (SIP) inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and EPA should discuss the regulatory significance of an exceptional events demonstration during the Initial Notification of Potential Exceptional Event prior to the air agency submitting a demonstration for EPA's review.

Narrative Conceptual Model

The 2016 EER directs air agencies to submit, as part of the demonstration, a narrative conceptual model of the event that describes and summarizes the event in question and provides context for analyzing the required statutory and regulatory technical criteria. Air agencies may support the narrative conceptual model with summary tables, maps or other figures or graphics that facilitate understanding of the event and the resulting monitored exceedance or violation. For stratospheric O₃ intrusion events, EPA recommends that the narrative conceptual model also discuss the local geography/topography, the meteorological conditions that led to the intrusion, how the O₃-containing stratospheric air created elevated ground-level O₃ concentrations at the affected monitor(s), the chemistry of typical non-event O₃ formation in the area, and, under 40 CFR §50.14(a)(1)(i), the regulatory significance of the requested data exclusion.

Clear Causal Relationship and Supporting Analyses

EPA considers a variety of evidence when evaluating whether there is a clear causal relationship between the specific event and the monitored exceedance or violation. For stratospheric O₃ intrusion events, air agencies should compare the O₃ data requested for exclusion with seasonal and annual historical concentrations at the air quality monitor to establish a clear causal relationship between the event and monitored data. In addition to providing this information on the historical context for the event-influenced data, air agencies should further support the clear causal relationship criterion by providing evidence that the O₃-containing stratospheric air was transported into the troposphere and that this O₃-rich air reached the ground-level monitor.

Not Reasonably Controllable or Preventable

EPA requires that air agencies establish that the event be both not reasonably controllable and not reasonably preventable at the time the event occurred. This requirement applies to both natural events and events caused by human activities; however, it is presumed that stratospheric O₃

intrusion events satisfy both factors of the “not reasonably controllable or preventable” element unless evidence in the record clearly demonstrates otherwise.⁶

Natural Event or Event Caused by Human Activity That is Unlikely to Recur

The 2016 EER preamble acknowledges that stratospheric O₃ intrusion events are natural events. Once an agency provides evidence that a stratospheric O₃ intrusion occurred and demonstrates that there is a clear causal relationship between the measurement under consideration and the event, EPA expects minimal documentation to satisfy the “human activity that is unlikely to recur at a particular location or a natural event” element.

EPA REVIEW OF EXCEPTIONAL EVENTS DEMONSTRATION

On November 22, 2016, the Ute Indian Tribe submitted an exceptional events demonstration for a stratospheric O₃ intrusion event that caused eight exceedances of the 2015 8-hour O₃ standard at the tribal-operated Myton, Whiterocks, Ouray, and Redwash monitoring stations within the Uinta Basin of Utah on June 8-9, 2015. In light of the analysis provided in the demonstration, the Ute Tribe concluded that the eight exceedances measured on June 8-9, 2015, were “unseasonably high, not consistent with historical readings and patterns, and that they coincided with the intrusion of stratospheric air into the troposphere contributing ozone to the surface measurements.” Accordingly, the demonstration requests “that the EPA concur on stratospheric ozone exceptional event flags the tribe has applied to the impacted data in the AQS database, and that the EPA exclude the exceedances . . . from calculations of O₃ exceedances and violations for 2015.”

Regulatory Significance

EPA determined that the exclusion of these eight exceedances may have regulatory significance for initial area designations for the 2015 8-hour O₃ standard. Specifically, the exclusion of the event-influenced data is likely to make a difference between a marginal and moderate classification for the Uinta Basin in Utah for the 2015 8-hour O₃ NAAQS if initial area designation decisions are based on data from years 2014 through 2016. Table 1 summarizes these exceedances.

Table 1: EPA 8-hour O₃ Exceedance Summary

Exceedance Date	Monitor/Site Name	AQS ID	8-hour Avg. (ppm)	Annual Rank
June 8, 2015	Ouray	49-047-2003	0.071	1 st
	Redwash	49-047-2002	0.074	1 st
	Myton	49-013-7011	0.071	2 nd
	Whiterocks	49-047-7022	0.073	1 st

⁶ According to 40 CFR §50.14(b)(6), “Where a State demonstrates to the Administrator’s satisfaction that emissions from stratospheric intrusions caused a specific air pollution concentration in excess of one or more national ambient air quality standard at a particular air quality monitoring location and otherwise satisfies the requirements of this section, the Administrator will determine stratospheric intrusions to have met the requirements identified in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably controllable or preventable criterion and shall exclude data from use in determinations of exceedances and violations.”

Exceedance Date	Monitor/Site Name	AQS ID	8-hour Avg. (ppm)	Annual Rank
June 9, 2015	Ouray	49-047-2003	0.071	2 nd
	Redwash	49-047-2002	0.072	2 nd
	Myton	49-013-7011	0.072	1 st
	Whiterocks	49-047-7022	0.073	2 nd

Narrative Conceptual Model

The Ute Tribe's demonstration provided a narrative conceptual model to describe how O₃-containing stratospheric air was transported into the troposphere and caused O₃ exceedances at the tribal-operated Myton, Whiterocks, Ouray, and Redwash monitoring stations. The conceptual model discussed local geography/topography and the meteorological conditions that led to the stratospheric O₃ intrusion and provided a depiction of the area showing the monitor locations (*see* page 4 of the demonstration) and a seasonal time series plot depicting 8-hour O₃ concentrations at remote, rural, high-elevation monitoring sites in the intermountain west during May and June of 2015 (*see* page 6 of the demonstration).

Specifically, the demonstration's conceptual model characterized the Uinta Basin of Utah as a winter O₃ region, which, in a typical year, records its highest O₃ concentrations in December through mid-March when the area experiences cold, clear high pressure conditions with low wind speeds and significant snow cover. But from December 2014 through March 2015, the Uinta Basin did not experience persistent snow cover or the typical wintertime O₃ production, and the two highest O₃ days were recorded on June 8-9, 2015, which is very unusual for the area. The conceptual model attributes these elevated levels to a stratospheric O₃ intrusion and explains that beginning on June 4, 2015, a closed upper level low around California slowly moved east and weakened, leaving an elongated zone of lowered tropopause heights, low pressure, and elevated free troposphere and total column O₃ stretching from Nevada into Colorado and Wyoming. As this upper level low system moved through the intermountain west in early June 2015, remote, rural high elevation O₃ monitors in Nevada, Utah, Wyoming, and Colorado recorded relatively high levels of O₃ that, during the May 25-June 1 period, had not exceeded 8-hour O₃ values above 60 ppb.⁷

Table 2: Documentation of Narrative Conceptual Model

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
June 8-9, 2015	Section 2: pp. 4-6	Sufficient	Yes

Clear Causal Relationship and Supporting Analyses

The Ute Tribe's demonstration established a clear causal relationship between the monitored concentrations under consideration and the stratospheric O₃ intrusion event. The demonstration included a comparison of the O₃ data requested for exclusion with seasonal and annual historical

⁷ The seasonal time series plot identified as Figure 2 in the demonstration shows a decrease in the 8-hour O₃ concentrations on June 4-5, 2015, at several of the high-elevation monitors. As acknowledged in the demonstration, thunderstorms can both enhance the transport of free tropospheric and stratospheric O₃ to the surface or, as was the case on June 4-5, lower surface O₃ while still showing the effects of the intrusion.

concentrations at the four monitors (see Table 2 and Figures 4-7 in the Ute Tribe's demonstration). The demonstration further showed that O₃-containing stratospheric air was transported into the troposphere and that this O₃-rich air reached the ground-level monitors.

Specifically, the demonstration included plots of daily maximum 8-hour average O₃ concentration against the day of year, for, at a minimum, all data in the years 2011, 2013-2015 (data periods presented in Figures 4-7 varied for each monitor). The demonstration also provided plots of diurnal O₃ compared to historical norms. Considered together, these plots compare the event-related exceedances with historical concentrations. A summary table (Table 2 in the Ute Tribe's demonstration) provided further comparisons to mean and maximum concentrations for the base period, as well as percentiles and ranks for the event-related exceedances. As indicated in Table 2, the June 8-9 concentrations recorded at the four subject monitors rank in the top five readings for the April-June data set. In addition, the recorded concentrations are among the top 94-99th percentiles in annual data recorded (*i.e.*, even including the typically higher wintertime O₃ months, these days show a peak) further indicating that the concentrations identified for exclusion are not consistent with historical annual and seasonal data.

The demonstration also included synoptic-scale meteorological observation and sounding analyses at upper and mid-low levels of the atmosphere, which illustrate conditions conducive to a stratospheric intrusion. Satellite images of NOAA's Geostationary Operational Environmental Satellite total column O₃ (Figures 27-29 in the Ute Tribe's demonstration) show higher O₃ levels coincident with these meteorologically-conducive areas. Additionally, as shown in Figures 35-36 in the Ute Tribe's demonstration, specific output parameters of the North American Mesoscale (NAM) forecast system indicate conditions conducive to stratospheric intrusion in three-dimensional space over the Uinta Basin and down to a level of 4000-5000 meters. Modeling of O₃ vertical distribution produced by the NOAA Realtime Air Quality Modeling System (Figures 37-41 in the Ute Tribe's demonstration) support the vertical profile suggested by NAM. Upper-air soundings for Grand Junction, CO (Figure 43 in the Ute Tribe's demonstration) and Flagstaff, AZ (Figure 44 in the Ute Tribe's demonstration, misnamed as Albuquerque, NM in the text but correctly labeled in the figure) illustrate meteorological conditions conducive to stratospheric intrusion as low as 4000 meters. These soundings also show maximum height of the mixed layer—calculated by EPA as part of the demonstration review process using the soundings provided in the Ute Tribe's demonstration and the dry adiabatic/mixing ratio method—to be at least 4400 meters at times during June 8-9, demonstrating transport of stratospheric O₃ to the ground-level monitors.

The analyses included in the Ute Tribe's demonstration, specifically those elements mentioned earlier in this section, sufficiently demonstrate a clear causal relationship between the stratospheric O₃ intrusion event and the eight exceedances measured at the Myton, Whiterocks, Ouray, and Redwash monitoring sites on June 8-9, 2015.

Table 3: Documentation of Clear Causal Relationship and the Supporting Analyses

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
June 8-9, 2015	Section 3 (Clear Causal Relationship): pp. 7-50 Section 4 (Affects Air Quality): pp. 50-52 Section 5 (No Exceedance But For): p. 53	Sufficient	Yes

Not Reasonably Controllable or Preventable

The EER presumes that stratospheric O₃ intrusion events are not reasonably controllable or preventable. 40 CFR §50.14(b)(6). Through the analyses provided in the clear causal relationship portion of the demonstration, the Ute Tribe established that a stratospheric O₃ intrusion occurred and caused the identified exceedances. Therefore, the documentation provided demonstrates that the event was not reasonably controllable and not reasonably preventable.

Table 4: Documentation of not Reasonably Controllable or Preventable

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
June 8-9, 2015	Section 7: pp. 53-54	Sufficient	Yes

Natural Event or Event Caused by Human Activity That is Unlikely to Recur

The 2016 EER preamble acknowledges that stratospheric O₃ intrusion events are natural events. The Ute Tribe's demonstration establishes that the event in question was a stratospheric O₃ intrusion. The Ute Tribe has therefore shown that the event was a natural event.

Table 5: Documentation of Natural Event

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
June 8-9, 2015	Section 6: p. 53	Sufficient	Yes

Schedule and Procedural Requirements

In addition to technical demonstration requirements, 40 CFR §50.14(c) and 40 CFR §51.930 specify schedule and procedural requirements an air agency must follow to request data exclusion. Table 6 outlines EPA's evaluation of these requirements.

Table 6: Schedules and Procedural Criteria

	Reference	Demonstration Citation	Criterion Met?
Did the agency provide prompt public notification of the event?	40 CFR §50.14 (c)(1)(i)	N/A	Yes – event not recognized until after exceedances recorded, but notice provided through the public comment process.
Did the agency submit an Initial Notification of Potential Exceptional Event and flag the affected data in the EPA's Air Quality System (AQS)?	40 CFR §50.14 (c)(2)(i)	See discussion in the Overview portion of this TSD	Yes
Did the initial notification and demonstration submittals meet the deadlines for data influenced by exceptional events for use in initial area designations, if applicable? Or the deadlines established by EPA during the	40 CFR §50.14 Table 2	See discussion in the Overview portion of this TSD	Yes

	Reference	Demonstration Citation	Criterion Met?
Initial Notification of Potential Exceptional Events process, if applicable?			
Did the agency conduct a public comment period for a minimum of 30 days?	40 CFR §50.14 (c)(3)(v)(A)	See discussion in the Overview portion of this TSD and footnote 4	Yes
Did the agency submit the public comments it received along with its demonstration?	40 CFR §50.14 (c)(3)(v)(B)	See discussion in the Overview portion of this TSD and footnote 5	Yes
Did the agency address in its submission those public comments disputing or contradicting factual evidence provided in the demonstration?	40 CFR §50.14 (c)(3)(v)(C)	N/A	N/A
Has the agency met requirements regarding submission of a mitigation plan, if applicable?	40 CFR §51.930(b)	N/A	N/A

CONCLUSION

EPA has reviewed the documentation provided by the Ute Tribe to support claims that O₃-containing stratospheric air was transported into the troposphere and that this O₃-rich air reached the ground-level monitors and caused exceedances of the 2015 8-hour O₃ NAAQS at the tribal-operated Myton, Whiterocks, Ouray, and Redwash monitoring stations on June 8-9, 2015. EPA has determined that the flagged exceedances at these monitoring sites on June 8-9, 2015, satisfy the exceptional event criteria: the event was a natural event, which affected air quality in such a way that there exists a clear causal relationship between the event and the monitored exceedance, and was not reasonably controllable or preventable. EPA has also determined that the Ute Tribe has satisfied the procedural requirements for data exclusion.

Appendix A: Regulatory Crosswalk between the 2007 and 2016 Exceptional Events Rules

Technical Criteria Under the 2016 EER	Related Criteria Under the 2007 EER	Demonstration Citation	Criterion met
Initial notification of potential exceptional event [40 CFR §50.14(c)(2)]	N/A	N/A	Yes – event not recognized until after exceedances recorded, but notice provided through the public comment process.
A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s) [40 CFR §50.14(c)(3)(iv)(A)]	N/A	Section 2: pp. 5-6	Yes
A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation [40 CFR §50.14(c)(3)(iv)(B)]	The event affects air quality [40 CFR §50.1(j), 40 CFR §50.14(c)(3)(iv)(A)]	Section 4: pp. 50-52	Yes
	There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area [40 CFR §50.14(c)(3)(iv)(B)]	Section 3: pp. 7-50	Yes
	There would have been no exceedance or violation but for the event [40 CFR §50.14(c)(3)(iv)(D)]	Section 5: p. 53	Yes
Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the clear causal relationship requirement [40 CFR §50.14(c)(3)(iv)(C)]	The event is associated with a measured concentration in excess of normal historical fluctuations, including background [40 CFR §50.14(c)(3)(iv)(C)]	Section 3A: pp. 7-22	Yes
A demonstration that the event was both not reasonably controllable and not reasonably preventable [40 CFR §50.14(c)(3)(iv)(D)]	The event is not reasonably controllable or preventable [40 CFR §50.1(j), 40 CFR §50.14(c)(3)(iv)(A)]	Section 7: pp. 53-54	Yes

Technical Criteria Under the 2016 EER	Related Criteria Under the 2007 EER	Demonstration Citation	Criterion met
A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event [40 CFR §50.14(c)(3)(iv)(E)]	The event is caused by human activity that is unlikely to recur at a particular location or a natural event [40 CFR 50.1(j), 40 CFR §50.14(c)(3)(iv)(A)]	Section 6: p. 53	Yes
Documentation that the State followed the public comment process and conducted at least a 30-day comment period [40 CFR §50.14(c)(3)(v)(A)]	The State must document that the public comment process was followed [40 CFR §50.14(c)(3)(v)]	See discussion in the Overview portion of this TSD and footnote 4	Yes
Submit the public comments with the demonstration [40 CFR §50.14(c)(3)(v)(B)]	N/A	See discussion in the Overview portion of this TSD and footnote 5	Yes
Address in the demonstration those comments disputing or contradicting factual evidence provided in the demonstration [40 CFR §50.14(c)(3)(v)(C)]	N/A	N/A	N/A